



# Invasive Causing Extinction, a USDA program



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## The global challenge of Invasive Species

- Recognized in all continents
- Aggravated by globalization, trade, mobility and climate change
- Invasives have significant negative impacts on natural ecosystems, affecting environmental quality and biodiversity
- The Invasive Species Compendium (ISC) provides a key resource to deal with invasives and biodiversity

**Knowledge** is key to deal with invasives and promote recovery of threatened species



# Threats to biodiversity

**The Convention on Biological Diversity:**  
stated that the two major threats to affect biodiversity in the next 20 years are **climate change** and **invasive species** (COP10 in 2011).

“Invasive species are the second biggest driving force of species extinction, after the effects of human activity (habitat loss, overexploitation, and pollution).”



## **USDA's Invasives Causing Extinction Program (ICE)**

Addresses the issue of extinctions due to impacts of invasives on U.S. biodiversity.

ICE links to and enhances the Invasives Species Compendium (ISC).

ICE used USDA staff and funds to date.

Many collaborators: CABI, Conservation Breeding Specialist Group/IUCN, USFWS, NMFS, universities, others...



# Invasive Species Compendium (ISC)

- Global, science-based, on the web, updated weekly
- Covers all natural and managed ecosystems (not human pathogens)
- Datasheets on 9,500 invasives in all taxa
- Free to users, fully funded (\$4.75 M)
- Focus: species with highest invasiveness & impact (includes two environmental impacts of IS: to habitats and to biological diversity)

## Key issues addressed by the ISC related to biodiversity of interest to ICE Program

- Avoid extinctions and protect biodiversity
- Assess / mitigate impact of invasives under climate change
- Facilitate legislation, policy or regulations

# Elements of ISC invasive species datasheet

- Identity
- Geographic distribution
- Biology and ecology
- Impact
  - Economic; social; **environmental**: to habitats and **to biodiversity (endangered and threatened species)**
- Management
  - **Prevention; control (cultural, mechanical, biological, chemical, genetic, utilization); eradication**; containment; surveillance; ecosystem restoration
- Gaps in knowledge / Research needs
- References and Illustrations



## Drivers for USDA's Invasives Causing Extinction (ICE) Program

1. Need to prioritize the additional invasive species (IS) for which we want to do a full ISC datasheet. High attention is warranted to include IS that are causing the extinction of other species.
2. Species Extinctions: we continue to lose endangered and threatened species in the U.S. because of the negative impacts of invasives. The rate and quantity of extinctions is accelerating. We want to minimize extinctions.





# Components of ICE Program

## 1. Link Invasives with “Threatened” species

- Identify endangered species (spp.) affected by IS. Over 66 % of U.S. endangered spp. listed by Dec. 2011 are affected by 1 to 15 invasive species!
- Link this knowledge to an ISC invasive species datasheet, under “Impacts to Biodiversity” section. Prepare “threatened species” table with the invasive and associated threatened spp. taxonomic and common name, location of threatened spp. (U.S. state), IS mechanism to affect threatened spp., references in IS datasheets (ds). In progress (2012-16).
- Future work: Identify threatened, candidate & spp. proposed for listing affected by IS (FY13); link information to ISC (FY14-16) ds and do new IS datasheets. Do ds for each “threatened” species (FY15-19); Model ds done 2011.



# Components of the ICE Program



## 2. Systematic Review: do Invasives Cause Extinction?

Purpose: Corroborate the **scientific basis for the ICE Program**.

Examine what evidence exists of invasive species impacting endangered/threatened/candidate spp.; highlight the mechanisms of impact; and identify species pairs of impact which can be used to set national priorities for the control of invasives and the protection of endangered, threatened or candidate spp. Do we have the correct scientific research to prove the hypothesis that invasives cause extinction?  
(FY12-13)

Scale: Investigation 1 year (\$95k), 13,000 references.

Systematic Review of all scientific journals & reliable science information in English, focusing on U.S., for endangered, threatened & candidate species listed by Dec. 2011.

# ICE Systematic Review Questions

Main question: “What is the **evidence** that invasive species are a significant contributor to the decline or loss of threatened species”

Sub question 1: “What **proportion** of threatened species have an invasive species as a significant contributor to their decline?”

Sub question 2: “Through what **mechanisms** do invasive species contribute towards the decline of native species?”



# ICE Systematic Review Results



## **What's the evidence that invasive species are a significant contributor to the decline or loss of threatened species?**

- Despite a lot of anecdotal evidence the number of rigorous scientific studies is limited - the priority is, understandably, to protect endangered species and remove invasive species rather than design a rigorous research impact study.
- The impact of invasive species has only been **studied rigorously for 6.5% of all USFWS listed and candidate species** as of December 2011.
- Where scientific evidence does exist, it is highly concerning: **80% of all evidence found shows invasive species to have a negative impact on threatened species.**



# ICE Systematic Review Results



## **What proportion of threatened species have an invasive species as a significant contributor to their decline?**

- 5.6% of all USFWS endangered, threatened and candidate species were found to have an invasive species as a significant contributor to their decline.
- 100 sources contained scientific evidence on the impact of invasive species on threatened species.
- Evidence for 165 unique species pairs of invasive species impacting USFWS endangered, threatened or candidate species was identified.
- The evidence collected will be fed directly into the Invasive Species Compendium (ISC).



# ICE Systematic Review Results



## Through what mechanisms do invasive species contribute towards the decline of native species?

- **Predation was the most common mechanism**  
(32% of all cases)

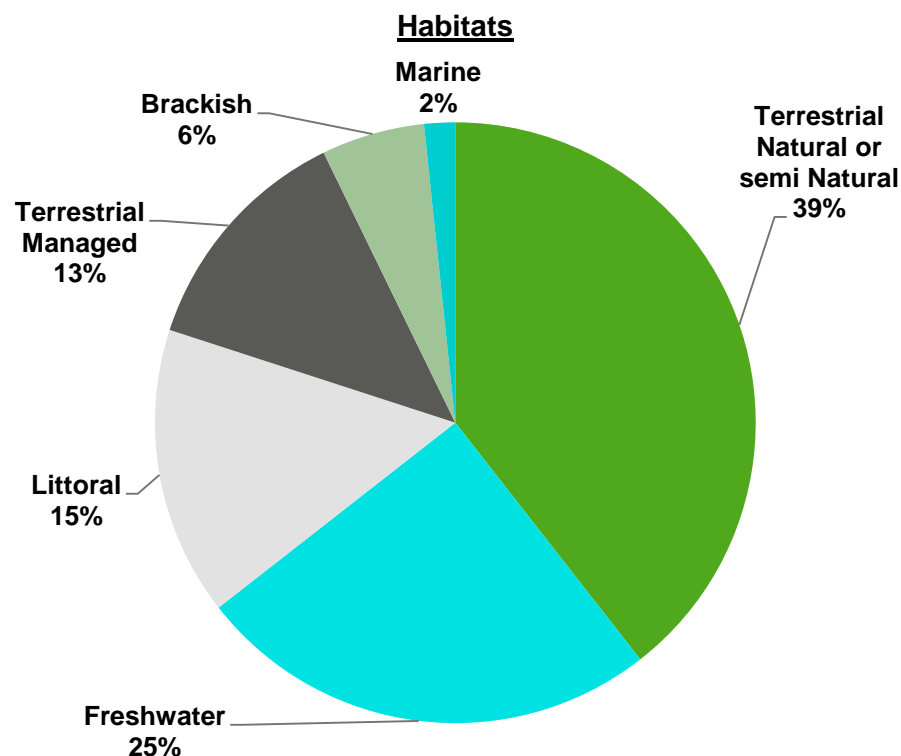
Mechanism	No. cases
Predation	49
Competition, monopolising resources	31
Herbivory or grazing or browsing	28
Behavioural disruption	15
Unknown	9
Parasitism	7
Ecosystem change or habitat alteration	4
Altered food web	2
Competition shading	2
Hybridization	2
Rooting or digging	2
Interaction with mutualisms	1
Interaction with other invasive species	1



# ICE Systematic Review Results



Habitat impact occurring in	No. of cases
Terrestrial Natural or semi Natural	71
Freshwater	45
Littoral	28
Terrestrial Managed	23
Brackish	10
Marine	3



Evidence of impact		No. of cases
Invasive	Threatened	
Mammal	Bird	27
Fish	Fish	23
Insect	Plant	19
Plant	Plant	17
Mammal	Plant	13
Plant	Bird	12
Bird	Amphibian	11
Amphibian	Amphibian	10
Mollusc	Plant	9
Fish	Amphibian	7
Mollusc	Mollusc	6
Insect	Bird	5
Mammal	Mammal	5
Mammal	Reptile	5
Bird	Mammal	4
Mollusc	Fish	4
Plant	Insect	4
Insect	Insect	3
Mollusc	Bird	2
Plant	Fish	2
Plant	Reptile	2
Amphibian	Fish	1
Bird	Plant	1
Fungi	Plant	1
Insect	Reptile	1
Protozoan	Mammal	1
Reptile	Bird	1



# ICE Systematic Review Results



- Evidence has largely come from Islands.
- There is a big research gap - what evidence there is shows there is cause for concern (80% of all evidence was negative impacts of IS on threatened species).
- This is just the picture for US listed and candidate species... data needs gathering for other parts of the world.

State/Region	No. cases
Hawaii	67
California	42
Arizona	15
Michigan	11
Galapagos island	10
Florida	6
Nevada	4
Georgia	3
Montana	3
Utah	3
Nebraska	2
New Mexico	2
Oregon	2
Alberta	1
Bahia	1
Guam	1
New Jersey	1
Puerto Rico	4
Quebec	1
Rocky Mountains	1
Surprise Island	1
Texas	1
Wyoming	1





# Components of the ICE Program

## 3. New Science tool: the Metamodel Analysis

Use Population Viability Analysis (PVA) models (traditionally used for small populations of threatened species) on a pair of species: an endangered and an invasive affecting it. Identify interactions among species and mechanisms.

Use the new Meta Model Manager (MMM) to let other models speak among themselves (PVA models, disease model, climate change model, habitat change model, etc.). This will identify additional knowledge to manage the interaction of the two species and avoid extinction of the threatened spp.

**First SUCCESSFUL effort for this new science tool:** analysis of impacts of the invasive Shiny Cowbird on the endangered Yellow-shouldered Blackbird in SW Puerto Rico (FY12).

#### 4. Enhance ISC by providing more IS datasheets

##### A. The worst 100 plant pathogen invasive species in the world

- 100 new datasheets of invasive plant pathogens in the world from all taxa were done by USDA - Agricultural Research Service's Systematic Mycology and Microbial Laboratory.
- 3 year project led by Dr. Amy Rossman.
- Funded by USDA (\$100K US).
- The 100 species datasheets are now included in the Invasive Species Compendium.



# Components of ICE Program



## 4. Enhance ISC by providing more IS datasheets

### B. Invasive Species (IS) causing extinction to U.S. endangered, threatened & candidate species (ICE project)

- 153 new datasheets of IS affecting endangered species were commissioned as of FY14, paid by USDA.
- Funds are needed for another identified about 150 IS affecting endangered species (FY14).
- Funds needed for additional datasheets ( $\approx$  700 spp.?) of IS affecting threatened spp. (FY15-16), candidate spp. (FY17) and spp. proposed for listing (FY15-16). The specific IS are being identified (FY13-14).



# Components of ICE Program

## 4. Enhance ISC by providing more IS datasheets

### C. Invasive plants in Caribbean islands:

Smithsonian is preparing ISC datasheets (FY11-18) (over 1,200 species to be done!) on invasive plants in Caribbean islands.

Working on invasives in Puerto Rico & US Virgin Islands (FY14); starting invasives in Hispaniola (Dominican Republic & Haiti) this year.

Participants: Dr. Pedro Acevedo, Dr. Julissa Rojas and two other experts at the National Natural History Museum, Smithsonian.

Progress: 70 datasheets done (FY12 USDA funds). Another 240 datasheets will be done by Sept. 2014 (FY13 \$150K).

# Components of ICE Program:

## Enhance ISC: Future potential projects:

1. ICE 150 datasheets (ds) on invasives (IS) affecting endangered or threatened species in military lands/waters: **DOD proposal** (FY15)
2. ICE 150 ds on IS affecting end. spp.: **FWS proposal** (FY14).
3. ICE: 500 ds on IS affecting endangered, threatened, candidate species or species proposed for listing: **NRCS** Technical Assistance Program (FY14)
4. ICE 150 ds on IS affecting end. or threatened species in national forests: **USFS** proposal (FY14)
5. Insects in or expected to arrive in PR & USVI: **Univ. PR** (FY15)
6. NAPPRA rule: species prohibited in U.S. nursery trade: **APHIS** PPQ (FY15)
7. Initiate a Systematic Review of IUCN critically endangered species (FY14-16)



## ICE Program's ultimate goal is:

**TO ACCOMPLISH CONSERVATION ACTIONS**  
that recover threatened species by managing the  
invasives that are causing their extinction

through

- Linking the world of invasive species managers with the world of endangered species experts so they can use the best available science to create synergism and conservation results
- Supporting USDA compliance with the Endangered Species Act Section 7a(1) to assist in the recovery of species and protection of biological diversity in the USA



# Questions on ICE Program?

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